

WA 2314  
No date  
16

FILE COPY

APPENDIX A

TACOMA PLANT

HISTORY & PROCESS DESCRIPTION

USEPA RCRA



3017998

## HISTORY OF THE TACOMA PLANT

Occidental Chemical Corporation's Tacoma Plant began operations in February 1929 producing chlorine and caustic soda by the electrolysis of sodium chloride brine. Production capacity was increased in 1934, 1937, 1940, 1950, 1953, 1956, 1970 through 1975, and 1981. These increases raised production capacity from 40 tons per day of chlorine in 1929 to 545 tons per day of chlorine in 1981.

In January 1947 the Solvents Facility was started up. This facility produced trichloroethylene and perchloroethylene from calcium carbide. The facility was shutdown in mid-1973.

Other production units which were, or are being operated at the Tacoma Plant include:

- (a) A fish oils hydrogenation unit which was started up in 1939 and shutdown in 1952.
- (b) An aluminum chloride production unit, operated as part of the war time effort, which started up in approximately 1942 and was shutdown in about 1945.
- (c) An ammonia unit was started up in 1952 and is presently operating. (However, it was shutdown from late October 1979 through May 1981.)
- (d) A calcium chloride unit. The original unit was started up in 1965 and ran until 1973. In this unit, calcium chloride was produced by evaporating the trichloroethylene plant stripper effluent. In 1974 a unit was started up which produces calcium chloride by reacting limestone with muriatic acid. This unit is operating today.
- (e) A muriatic acid production unit was started up sometime before 1936 and in 1974 a new unit was installed which is presently operating.
- (f) A sodium hypochlorite unit was started in 1974 and is presently operating.



## CHLORINE AND CAUSTIC SODA

Chlorine and caustic soda are produced by the electrolysis of brine (a mixture of sodium chloride and water) in a diaphragm-type electrolytic cell.

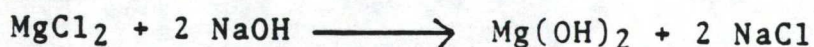
Salt received at the Plant is stored on outdoor paved and diked areas. It is dissolved with water and treated with chemicals (sodium carbonate,  $\text{Na}_2\text{CO}_3$ , and sodium hydroxide,  $\text{NaOH}$ ) to precipitate unwanted impurities. The impurities (calcium carbonate,  $\text{CaCO}_3$ , and magnesium hydroxide,  $\text{Mg}(\text{OH})_2$ ) are then settled out in tanks, leaving a sodium chloride brine solution. The solution is filtered and then fed to the electrolytic cells where chlorine gas, hydrogen gas, and a weak caustic soda (cell liquor) solution is produced.

The chlorine gas coming from the cells is hot and wet. The chlorine gas is cooled in direct contact and indirect contact coolers, dried by direct contact with sulfuric acid in drying towers, compressed to 35 pounds per square inch by turbines, purified by scrubbing with liquid chlorine in the purification column, (chlorinated organic bottoms from the purification column are incinerated) liquefied by refrigeration equipment, and then stored as a liquid product. Vent gas from the chlorine process is bubbled into tanks containing caustic soda solution to produce a bleach (sodium hypochlorite,  $\text{NaOCl}$ ) solution as product or to produce a salt water solution which is recycled to the brine process.

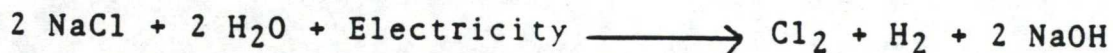
The weak caustic soda (cell liquor) from the electrolytic cells is a dilute solution saturated with salt. The (50%) commercial grade caustic soda solution is obtained by evaporating water from the weak caustic soda solution in the preconcentrator and triple effect evaporators. The commercial grade caustic soda solution is cooled to precipitate salt from the solution and centrifuged to separate the salt from this solution. The salt is recycled to the brine process for further electrolysis. The caustic soda is then stored in product storage tanks.

### Chemistry:

#### Brine Purification



#### Electrolysis of Brine



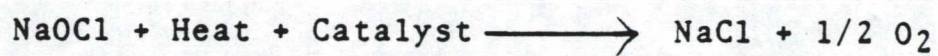
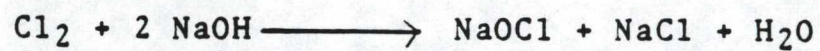


Chlorine Gas Neutralization:

Bleach Production



Salt Recovery



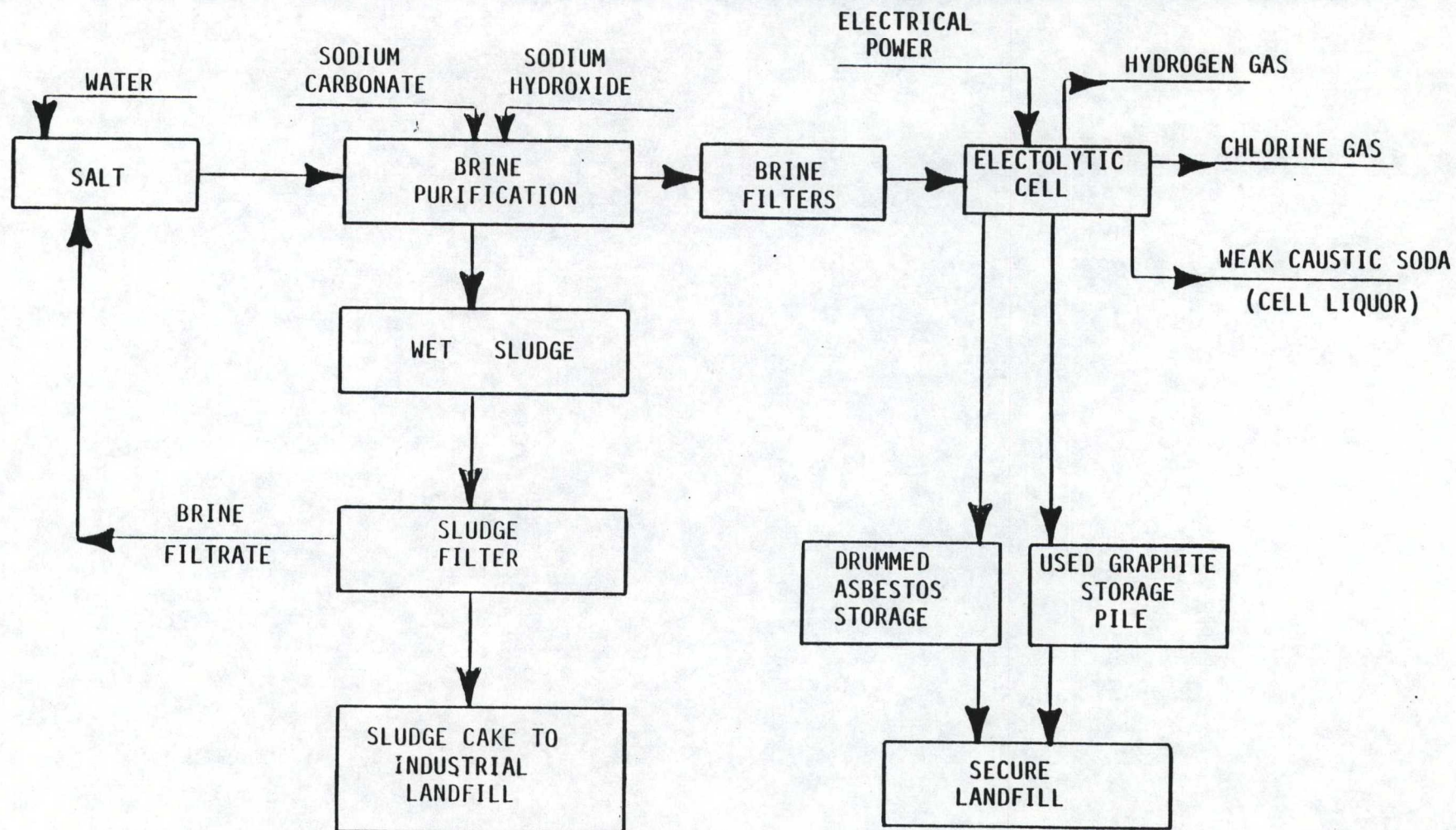


figure A-1

BRINE ELECTROLYSIS (PRESENT)  
*Tacoma, Wa.*



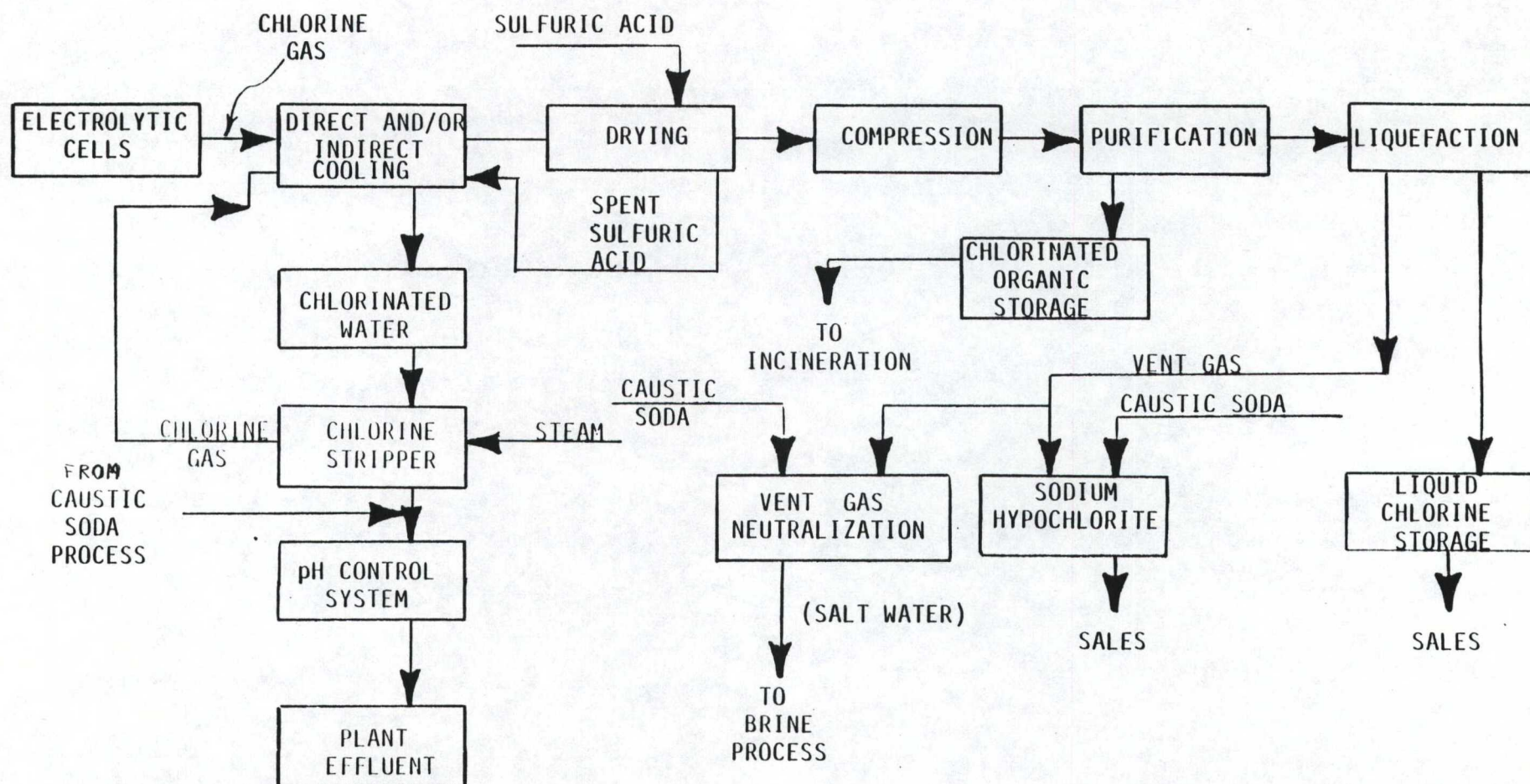


figure A-2  
 CHLORINE, SODIUM HYPOCHLORITE,  
 AND VENT GAS NEUTRALIZATION  
*Tacoma, Wa.*



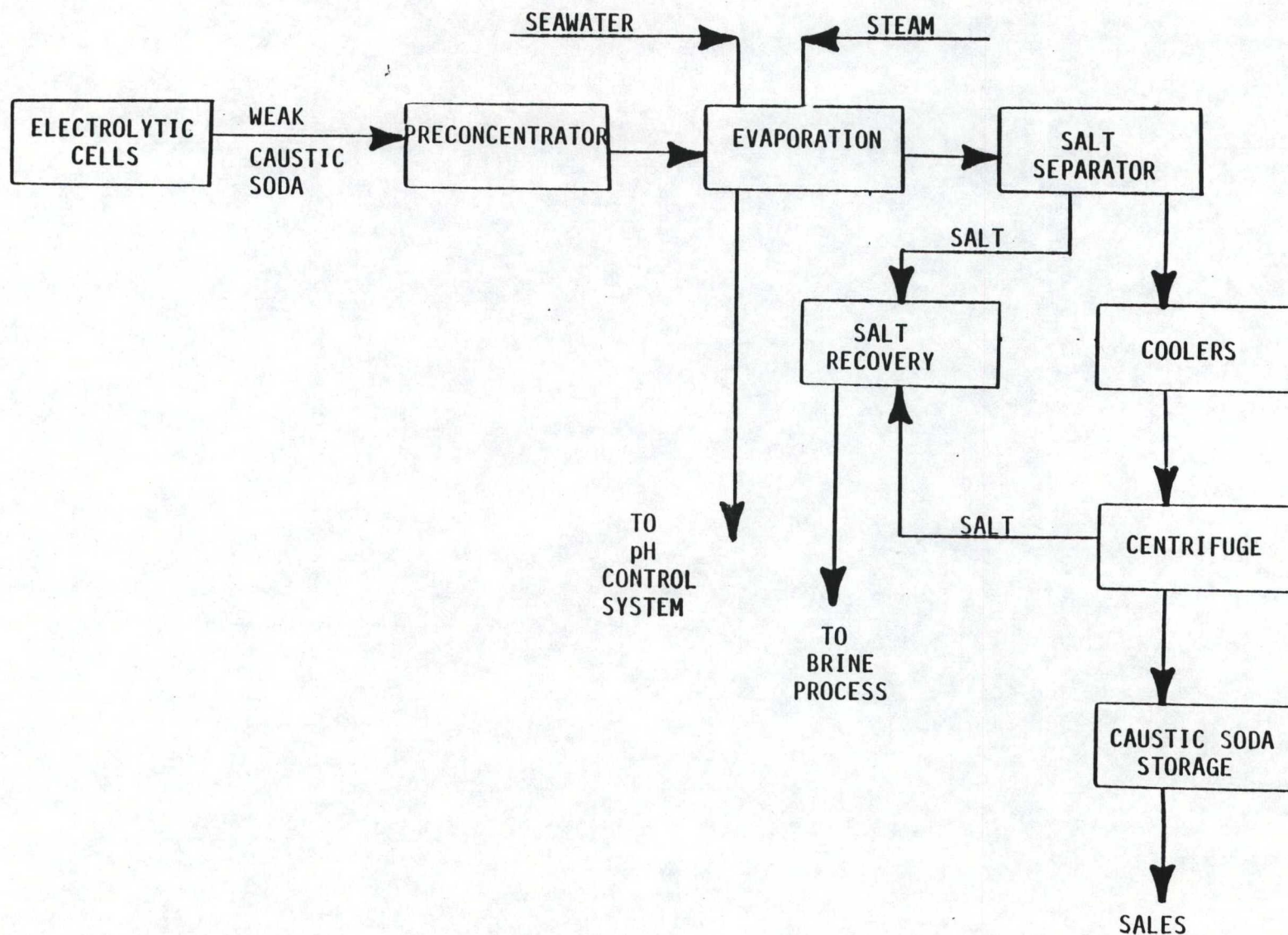


figure A-3  
CAUSTIC SODA PROCESS  
*Tacoma, Wa.*



## TRICHLOROETHYLENE/PERCHLOROETHYLENE PROCESSES

Trichloroethylene and perchloroethylene were produced from calcium carbide, chlorine, and water.

Calcium carbide was reacted with water to form acetylene. The acetylene was combined with chlorine to produce tetrachloroethane (tetra). Tetra was dehydrochlorinated in the hydrolyzer/stripper with lime to produce crude trichloroethylene. The crude trichloroethylene was distilled in a distillation column to produce pure trichloroethylene (TCE) which was used as product or fed to the perchloroethylene process. The calcium chloride solution from the hydrolyzer/stripper was sold as product or sent to the barge or to the lime ponds. The lime from the acetylene generator was used in the hydrolyzers/strippers to neutralize the hydrogen chloride gas generated in the hydrolyzers/strippers. The remaining lime from the generator was sold or sent to the lime ponds or barge. The still bottoms were batch distilled in the reboiler to recover trichloroethylene. The chlorinated organic residue from the reboiler was sent to the lime ponds or to the barge.

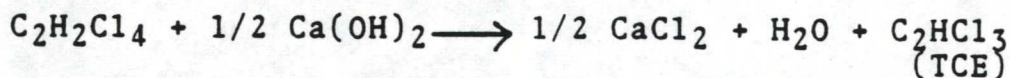
Perchloroethylene (PCE) was formed by reacting chlorine with trichloroethylene in the chlorinator to produce pentachloroethane (penta). Penta was dehydrochlorinated in the hydrolyzer/stripper with lime to produce crude perchloroethylene. The crude perchloroethylene was distilled in the distillation column to produce pure perchloroethylene. The calcium chloride solution from the hydrolyzer/stripper was sold as product or sent to the lime ponds or to the barge. The still bottoms were sent to the reboiler on a batch basis to recover material. The chlorinated organic residue from the reboiler was sent to the lime ponds or to the barge.

### Chemistry:

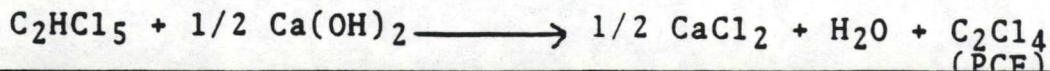
#### Acetylene Production



#### Trichloroethylene Production



#### Perchloroethylene Production









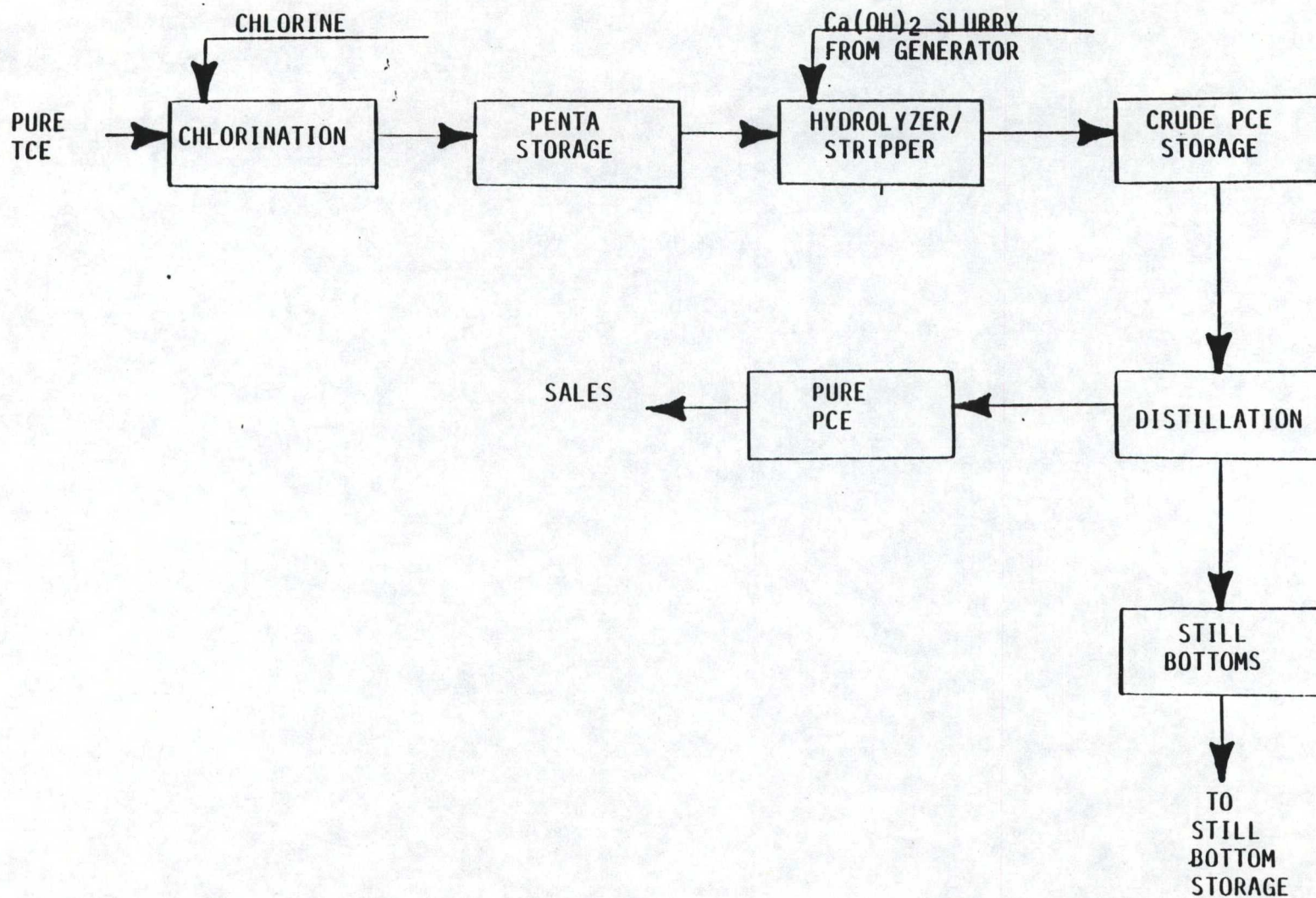


figure A-5  
PERCHLOROETHYLENE PROCESS  
Tacoma, Wa.



## AMMONIA AND MURIATIC ACID

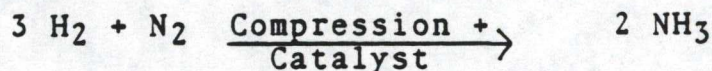
The hydrogen gas that is formed in the electrolytic cell, along with the chlorine gas and cell liquor, is used to produce both ammonia and muriatic acid.

Ammonia is made by compressing a mixture of three volumes of hydrogen with one volume of nitrogen and passing it through a converter packed with catalyst. The ammonia formed is condensed and drawn off to product storage. The vent gases from the ammonia plant are reacted with water to produce an ammonium hydroxide product.

Muriatic acid, the commercial name for hydrochloric acid, is made by burning hydrogen in chlorine atmosphere to form a hydrogen chloride gas which is absorbed in water.

### Chemistry:

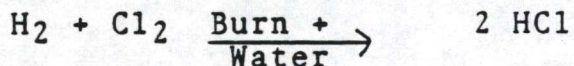
#### Ammonia



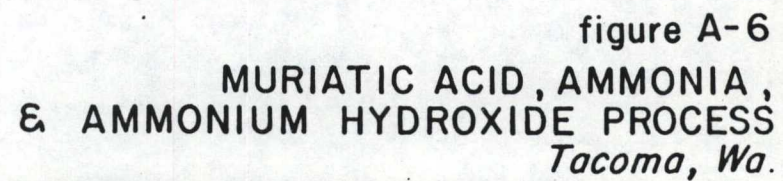
#### Ammonium Hydroxide



#### Muriatic Acid





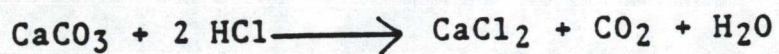




## CALCIUM CHLORIDE

Calcium chloride is currently made by combining muriatic acid and limestone ( $\text{CaCO}_3$ ) in a reactor tank. The product is settled and then transferred to product storage tanks (sold as 35% solution).

### Chemistry:





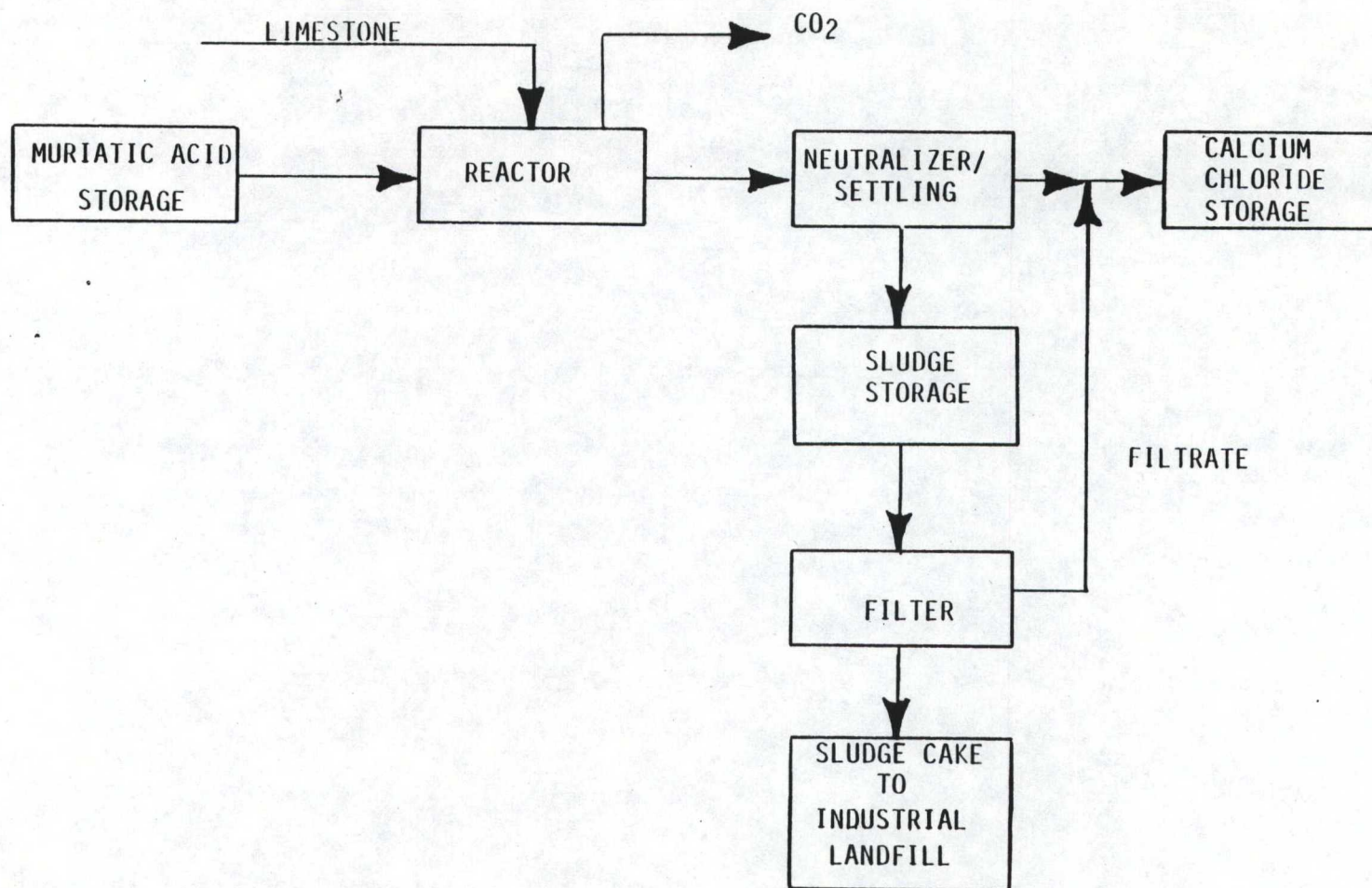


figure A-7  
CALCIUM CHLORIDE PROCESS  
*Tacoma, Wa.*



## HYDROGENATION OF FISH OILS

(Based Upon Best Available Information)

Fish (sardine and herring) oils were reacted with hydrogen gas to produce a more saturated oil with respect to hydrogen. This process converted the liquid oil into a solid form at ambient temperatures.

### Chemistry:

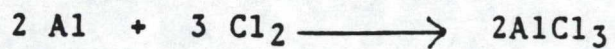




## ALUMINUM CHLORIDE

Aluminum chloride was produced by reacting chlorine gas with molten aluminum. The aluminum chloride was condensed and collected as product.

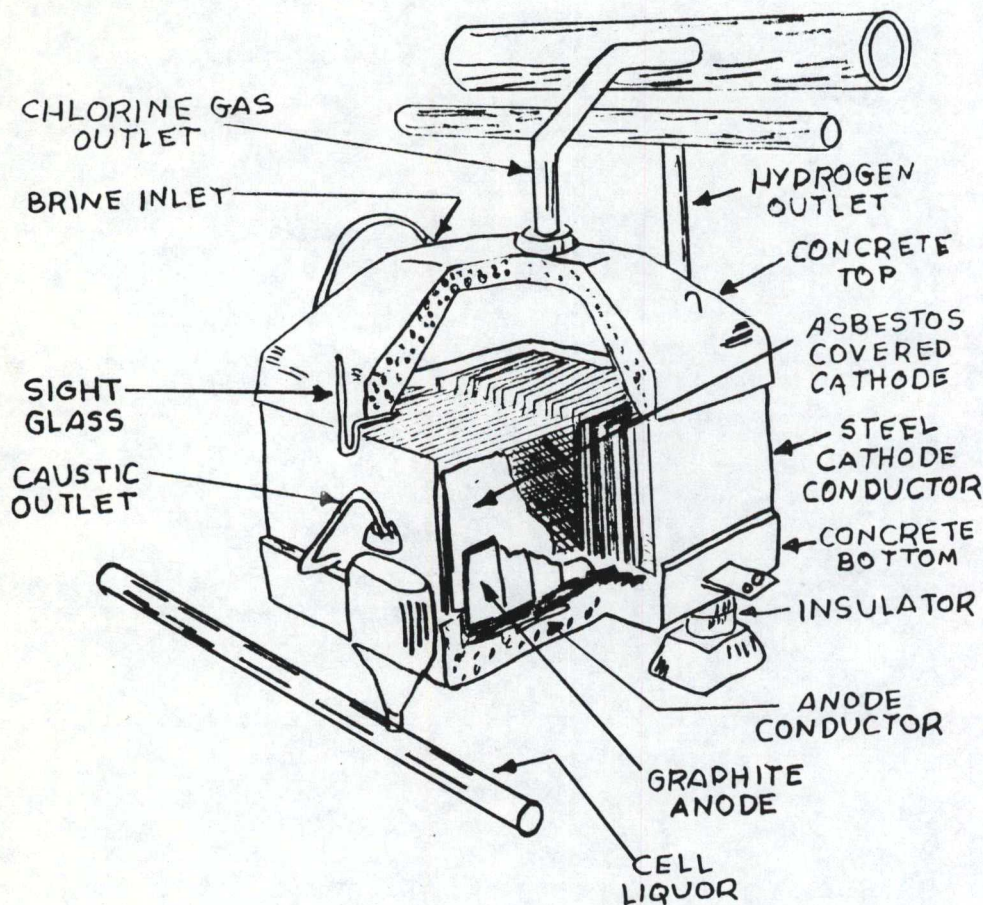
### Chemistry:



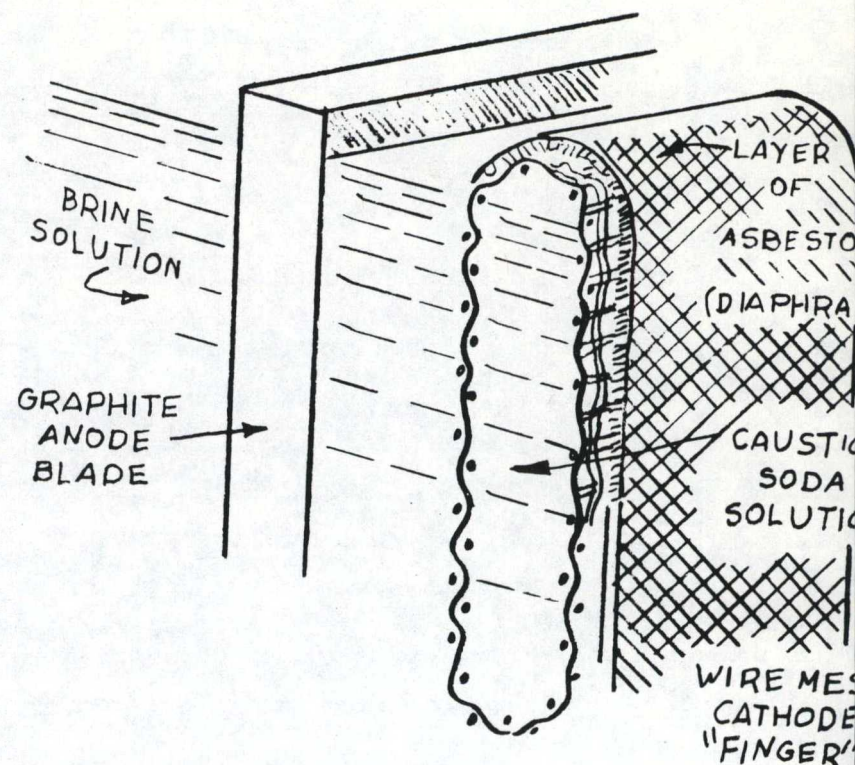


The Hooker type S-4 and C-60 electrolytic cells are the heart of the Chlorine plant. It is here where the brine and the electric current meet to form Chlorine, Hydrogen gas and an 11% solution of Caustic Soda.

AN S-4 CELL LOOKS LIKE THIS,



THE INSIDE LOOKS LIKE THIS,



This shows where the brine (NaCl + H<sub>2</sub>O) is changed into

Chlorine gas (Cl<sub>2</sub>)  
Caustic Soda (NaOH)  
and Hydrogen (H<sub>2</sub>)

